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10/080,468	02/22/2002	Hua Ji	M-12589 US	8384

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EXAMINER

MAI, ANH D

ART UNIT PAPER NUMBER

2814

DATE MAILED: 01/12/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/080,468

Applicant(s)

JI, HUA

Examiner

Anh D. Mai

Art Unit

2814

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-10, 12, 13, 15-26, 28 and 30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-10, 12, 13, 15-26, 28 and 30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ 6) ☐ Other: _____

DETAILED ACTION

Status of the Claims

1. Amendment filed September 29, 2003 has been entered. Claims 1, 19 and 30 have been amended. Claims 5, 11, 14, 27 and 29 have been canceled. Claims 1-4, 6-10, 12, 13, 15-26, 28 and 30 are pending.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-4, 6-10, 12, 13, 15-26, 28 and 30 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

The specification described a film deposition process including: "E/D ratios from 0.0 to about -0.05". The $E/D = (UBUC - BUC)/UBUC$

Where UBUC is deposition rate with no bias; and BUC is deposition rate with bias.

It is well known that, without bias, no etching component is present and with bias, there is an etching component. Therefore, the deposition rate of without bias (UBUC) is always larger than with bias (BUC).

The claimed invention, however, disclosed a negative E/D (- 0.05).

The negative E/D means $BUC > UBUC$.

How can BUC be large than UBUC while there is an etching component involved ?

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 1-4, 6-10, 12, 13, 15-26, 28 and 30 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Papasouliotis et al. (U.S. Patent No. 6,030,881) of record.

With respect to claim 1, Papasouliotis teaches method for filling a gap during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of silicon-containing and oxygen-containing components, wherein the oxygen-containing component is no more than 21% total concentration by volume of the gas mixture; (see table 1); and

performing an HDP-CVD process using the gas mixture to fill the gap with a dielectric (525) having a selected refractive index, wherein the ratio of the oxygen-containing component to the silicon-containing component is below about 1.2 (10/10=1) to form the dielectric having a selected refractive index and to fill the gap without cusp formation. (See Figs. 5A-C).

The dielectric material (525) of Papasouliotis is SiO₂, thus, has a selected refractive index.

With respect to “the oxygen-containing component is no more than 21% total concentration by volume of the gas mixture”, as shown in table 1, the inert gas flow rate are in the range of 10-1000 sccm, lets consider an inert gas flow rate of 30 sccm, thus,

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$10 \text{ (oxygen-containing gas)} / (10 \text{ (oxygen-containing gas)} + 30 \text{ (inert gas)} + 10 \text{ (silicon-containing gas)}) = 20\%$ (no more than 21%). Therefore, Papasouliotis clearly teaches an oxygen-containing component of no more than 21% total concentration by volume of the gas mixture

Further, note that the specification contains no disclosure of either the critical nature of the claimed *no more than 21% total concentration* of oxygen-containing components in the gas mixture or any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen percentage or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

With respect to claim 19, as best understood by the examiner, Papasouliotis teaches method for filling a gap during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of silicon-containing and oxygen-containing components, wherein the oxygen-containing component is no more than 21% total concentration by volume of said gas mixture; (see table 1); and

filling the gap without cusp formation by depositing the film (525) over the gaps (510) by using the gas mixture for simultaneous high density plasma chemical vapor deposition and sputter etching (HDP-CVD). (See Figs. 5A-C).

With respect to the “no more than 21% total concentration” and its criticality, similar reasoning as that of claim 1 is also applied here.

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With respect to claim 2, the silicon-containing and oxygen-containing components of Papasouliotis comprises a concentration (no more than 18%) by volume of the gas mixture as claimed.

With respect to claims 3, 6, 20 and 22, the silicon-containing and oxygen-containing components of Papasouliotis are at the flow rate that include claimed range.

With respect to claims 4 and 21, the silicon-containing component of Papasouliotis comprises silane.

With respect to claims 7 and 23, the oxygen-containing component of Papasouliotis comprises a O₂.

With respect to claims 8, 10, 24 and 26, the gas mixture of Papasouliotis is further includes an inert component, He.

With respect to claims 9 and 25, the inert component of Papasouliotis is at a flow rate (10-1000 sccm) that includes the claimed range (305-358 sccm).

With respect to claims 12 and 28, the ratio of oxygen-containing component to silicon-containing component of Papasouliotis includes the claimed ranges.

With respect to claim 13, the gas mixture of Papasouliotis is at pressure (5-65 mTorr) that overlaps the claimed range (3.5-5.5 mTorr).

With respect to claim 15, the dielectric (525) of Papasouliotis comprises silicon oxide.

With respect to claim 16, the dielectric (525) of Papasouliotis is SiO₂ thus, inherently having a refractive index of 1.46.

With respect to claim 17, the process of Papasouliotis further comprises: providing a low frequency power source operable to form plasma from the gas mixture, the low frequency power source is providing power (4-10 kW) that includes the claimed range (4.2-5.0 kW).

With respect to claim 18, the process of Papasouliotis further comprises: providing a high frequency power source operable to bias the substrate, the high frequency power source is providing power (0.1-5 kW) that includes the claimed range (1.0-1.4 kW).

With respect to claim 30, Papasouliotis teaches method for filling gaps during integrated circuit fabrication as claimed including:

providing a gas mixture comprised of oxygen-containing and silicon-containing components, wherein the gas mixture has a ratio of oxygen-containing component to silicon-containing component below about 1.3 (10/10=1), and further wherein the oxygen-containing component is no more than 21% total concentration by volume of said gas mixture; (see table 1); and

filling the gap without cusp formation by using the gas mixture for simultaneous high density plasma chemical vapor deposition and sputter etching (HDP-CVD). (See Figs. 5A-C).

With respect to the “no more than 21% total concentration” and its criticality, similar reasoning as that of claim 1 is also applied here.

Response to Arguments

4. Applicant's arguments filed April 21, 2003 with respect to the rejection under 35 U.S.C. 112, first paragraph, have been fully considered but they are not persuasive.

Note that the rejection is based on the enablement of the specification. Therefore, canceling the claims did not make the specification any more able.

A declaration from a qualified engineer is required to corroborate the Applicant statements.

The rejection is maintained.

Rejection under 35 USC § 102

The nature of the HDP-CVD is well known in the art and have been addressed before, therefore, further discussing about HDP-CVD is not warranted.

With respect to "no more than 21% total concentration", Applicant argues: Papasouliotis does not disclose or suggest a gas mixture including an oxygen-containing component that is no more than 21% total concentration by volume of the gas mixture.

The value of no more than 21% total concentration has been discussed above.

With respect to "oxygen-containing component to the silicon-containing component below about 1.2", see the rejection above.

With respect to claims 19 and 30, applicant appears to repeat the same argument with respect to claim 1. Therefore, the same response is also applied.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

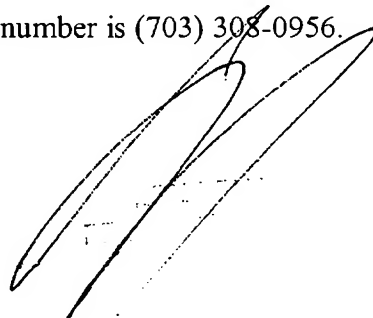
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M
January 5, 2004

A handwritten signature in black ink, appearing to be 'A.M.', is written over the signature line.